Center for Space Nuclear Research completes first year of summer student program

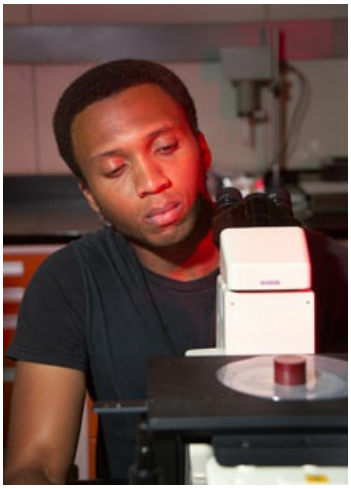
by Kimberly Cone, INL Communications intern

As fall begins, Idaho National Laboratory bids farewell to the first group of university students to work with the Center for Space Nuclear Research (CSNR) Summer Fellowship Program.

Earlier this year, the student program was conceived, approved and advertised to more than 400 universities. In just six months, the program was well under way with 13 fellows chosen out of 112 applicants.

The Universities Space Research Association established the CSNR at INL in late 2005 to advance research in space exploration. In-depth research focuses on applications of space power systems, nuclear electric and thermal propulsion systems and radioisotope power generators for future missions.

This summer, students conducted studies in fuel materials development, risk analysis and mission assessment. Their research could contribute to concepts that will allow nuclear power to support a lunar base and nuclear-powered spacecraft to carry cargo to the moon or to carry probes to the outer planets much faster than can current spacecraft.



CSNR fellowship student Brandon Cunningham investigated tungsten's dense metal properties as an alternative to carbon-based fuel.

"Nuclear power and propulsion are enabling for humans in space. Our spacecraft may need improved acceleration and higher velocities to support the transport of more material. Depending on the destination, solar power is simply not intense enough," said Steven Howe, CSNR director.

Nuclear technologies have been used in space exploration since the days of the Apollo missions. One technology is Radioisotope Thermoelectric Generators (RTGs) that provide a continuous flow of electricity, lasting several decades. Inside the RTG, plutonium-238 provides the heat that is converted to electricity.

Rovers on the Mars surface use radioisotope heater units to keep the systems warm and functioning. They have provided electrical power to almost every space mission beyond Mars, including missions to Saturn, Jupiter and Pluto. Some of these mission vehicles are still sending signals back to Earth from billions of miles away.

Future missions may require higher power levels than can be achieved through RTGs or solar power. Nuclear reactors powered by uranium might be needed for both spacecraft propulsion and for electrical power on the surface of the moon or Mars. President Bush's Vision for Space Exploration projects human missions to Mars by 2030, and the CSNR is working on concepts to enable development of efficient energy sources for power and propulsion for these missions.

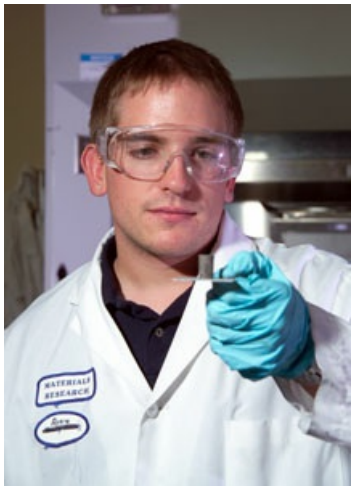
Brandon Cunningham, a CSNR fellowship student from the University of Florida, did research on new fuel types for a Mars spacecraft concept. In the past, concepts for spacecraft powered by nuclear energy used a carbon-based fuel. Researchers are now looking at alternative fuels.

Cunningham explored an advanced tungsten-based fuel. Tungsten is a dense metal with a melting point higher than the temperature of the sun's surface. The CSNR's goal is to contain the uranium for a nuclear-propelled spacecraft inside this dense material in order to operate the engine at much higher temperatures.

A nuclear engineering major, Cunningham has many career options but he is looking for anything to do with space.

"Space is our last frontier and I want to be there," Cunningham said.

Jeff Perkins is also a CSNR student and a materials and metallurgical engineering major from the Colorado School of Mines. He spent his summer in the spacious laboratories of the INL Research Center conducting hands-on metallurgical research. Perkins cold-pressed nickel mixed with zirconia into pellets that were then baked and observed for preliminary research aimed at finding an alternative to carbon.



CSNR student Jeff Perkins conducted metallurgical research to develop new fuels for use in nuclear-powered rockets.

Perkins also worked on interpreting studies conducted in the Rover/NERVA program, set up by the U.S. government in the 1960s to develop a nuclear-powered rocket. The engines were designed, built and tested but never flown. Today, Perkins and other CSNR students build on these past experiments.

"My experience at the laboratory has altered my perceptions as to how work is actually performed." Perkins said. "When I first arrived, I focused more on minute details; I had to readjust my thinking to somewhere in the middle. Now, I see the divisions in the grand scheme of a project and the minor details are resolved over the course of a project."

As director of CSNR, Howe works to strengthen collaborations between INL and universities nationwide.

"The advantages of working with universities are pragmatically educating students for future employment and the innovative ideas generated by the younger generations," Howe said. "Students tend to think up brand new ideas the rest of the scientific community may think impossible."

Perhaps within the next few decades, using the unique capabilities at INL, some of these ideas may take the first human beings to stand on the red sands of Mars.

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